# If at First You Don't Succeed: The Role of Evidence in Preschoolers' and Infants' Persistence.

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**Abstract**

Perseverance, above and beyond IQ, predicts academic outcomes in school age children. Yet, little is known about how very young children learn the contexts in which persistence is valuable (or not). Here, we explore how young children and infants learn about the rational deployment of effort through observing adults' persistent behavior. Results from Experiments 1 and 2 indicate that preschoolers persist more after watching an adult persist, but only if the adult is successful at reaching their goal. Experiment 3 extends these findings, showing that even infants use adult models to modulate their persistence, and can generalize this inference to novel situations. Thus, both preschoolers and infants are sensitive to adult persistence and use it to calibrate their own tenacity.

**Keywords:** learning, child development, motivation, persistence

## Introduction

American culture values effort and perseverance. This emphasis is substantiated by scientific research: grit and self-control predict high school grades and on-time graduation better than IQ (Duckworth & Seligman, 2005; Eskreis-Winkler, Shulman, Beale, & Duckworth, 2014). Even the way that children think about the relationship between hard work and achievement predicts school outcomes. For example, children who believe effort determines achievement out-perform those who believe ability is a fixed trait, even when controlling for ability (Blackwell, Trzesneiwki, & Dweck, 2007). Although considerable work has looked at achievement motivation and judgments of self-efficacy in school-age children (Bandura, 1977; Zimmerman & Blotner, 1979; Zimmerman & Ringle, 1981), relatively little is known about the development of children's tendency to persist in the face of frustration before they enter school. Here we consider the question of how very young children learn both the value of persistence, and the contexts in which persistence is (and is not) valuable.

In their own behavior, preschoolers are sensitive to contexts in which effort might pay off: children explore more, and more strategically, when the probability of information gain is high than when it is low (Bonawitz, et al., 2011; Cook, Goodman, & Schulz, 2011; Gweon, Pelton, Konopka & Schulz, 2014; Legare, 2012; Schulz & Bonawitz, 2007). However, relatively little is known about what evidence young children might use in deciding how long to persist in trying to achieve a goal.

One plausible source of evidence is children's own past experience of success and failure. Children are much more likely to indicate that they are "bad at solving puzzles" after experiencing failure than at baseline (Smiley & Dweck, 1994). Preschoolers are also more likely to imitate an adult's goal-directed actions if they have previously had difficulty achieving the outcome themselves (Williamson, Meltzoff, & Markman, 2008).

In novel contexts however, the best source of information for children about the value of persistence may be what adults say and do. For example, whether parents praise their toddlers for effort or for ability affects whether children believe intelligence is malleable or fixed many years later (Gunderson, Gripshover, Romero, Dweck, & Levine, 2013). Such patterns of approval (or disapproval) convey general information about the value of effort; however, adults can also convey specific messages about how long a child should persist on any given task. Children use adult models to learn both information that is causally relevant to their goals (Bekkering, Wohlschlager, & Gattis, 2000; Gergely, Bekkering, & Kiraly, 2002; Schulz, Hoopell, & Jenkins, 2008; Meltzoff, 1995) and behaviors that, although causally unnecessary, may be plausibly relevant to norms, conventions or broader social practices (Harris, 2012; Kenward, Karlsson, & Persson, 2011; Lyons, Young, & Keil, 2007; McGuigan, Whiten, Flynn, & Horner, 2007). This suggests that adults' tendency to persist or quit in the face of frustration might affect the probability that their children do the same, on specific tasks and more broadly.

However, children could learn two very different things from adults' persistence. They could learn the value of persistence or they could learn that achieving this goal is hard, even for adults. Preschoolers understand that adults are more knowledgeable than they are (e.g., Lutz & Keil, 2002) and sometimes even attribute omniscience to adults (Wimmer, Hogrefe, & Perner, 1988). If a task is difficult even for a grown-up, children might well conclude that they should not bother trying. Indeed, previous studies on achievement motivation have found that school-age children's persistence and judgments of self-efficacy are influenced both by adults' modeling and adults' statements of confidence (Zimmerman & Blotner, 1979; Zimerman & Ringle, 1981).

However, children under the age of five tend to be optimistic about their own abilities and typically over-estimate how well they will perform, especially at novel tasks (Schneider, 1998; see also Burhans & Dweck, 1995; Cimpian, 2010; Smiley & Dweck, 1994). As long as a behavior is plausibly within the child's repertoire, children may well persist despite the adult's difficulties. Insofar as children use adult models to determine when persistence will pay off, children should be especially likely to learn

from adult persistence if the adult is ultimately successful. By contrast, if an adult struggles and finally has to quit, children might be best served by learning that in this case, persistence is futile.

Critically, even if a child believes that persistence will pay off, she must decide how far to generalize this insight. If a child watches an adult struggle to open a door and succeed, the child could conclude that this particular door is hard to open and she should try hard to open it; or she could decide to persist given sticky doors in general; or she might learn that perseverance in the face of frustration is, in general, a good idea.

Although the most far-reaching effects of adults' behavior on children's persistence must await future work, here we evaluate the effect of adult persistence on children's persistence, both given adult success (Experiment 1), adult failure (Experiment 2), and in contexts where the adult and child have similar goals (Experiment 1 & 2) and in contexts where their goals differ (Experiment 3). Additionally, because most research on children's beliefs about persistence has focused on school-age children (see Yeager & Dweck, 2013) and little is known about its trajectory earlier in development, we begin our investigation with preschoolers (Experiment 1 & 2). We then see if the adult models affect children's persistence even in infancy (Experiment 3).

## Experiment 1

### Methods

**Participants and Materials** Fifty-nine 4-5 year-old children were recruited for the study, but only fifty-two were included in the data analysis (mean: 57.56 months; range: 48 - 71 months) due to parental interference (n = 1), no video recording (n = 2), not reaching criteria with the 'all done playing' bell (n = 1), not touching the toy box before ringing the bell (n=2), or successfully opening the toy box (which was supposed to be impossible; n = 1). Children were randomly assigned to one of two conditions: Immediate Success or Effortful Success (n = 26/condition; ages were matched across conditions. Confidence intervals reported from bootstrap on mean with 10,000 samples. $\beta$ = 1.5, 95% CI [-0.03, 0.08]).

Two 18.49 x 8.51 x 8.51 cm wooden boxes were used. The boxes looked like they could open in a few different ways, but they actually opened through a secret sliding notch. A marble was hidden in the experimenter's box and a rubber frog was hidden in the child's box. These toys produced different sounds when the box was shaken and were used to indicate that the boxes were different. A bell was used for the child to indicate that she was 'all done playing' and a toy bear was used to demonstrate the use of the bell.

**Procedure** Children were tested individually in a quiet room off an urban children's museum floor. In both conditions, the experimenter first introduced the child to the 'all done playing' bell. The experimenter pretended to play with the stuffed bear, and then said, "I'm all done playing" and rang the bell. The child was then asked to play with the bear and indicate when she was all done playing by ringing the bell. The procedure was repeated if the child didn't use the bell to indicate when she was done playing. If the child failed to ring the bell after three repetitions, they were excluded from the study.

In both conditions, the experimenter then brought out their wooden box and shook it, saying, "I think there's something inside of there!" In the *Immediate Success* condition, the experimenter took approximately 5 seconds to identify the sliding notch and opened the box. In the *Effortful Success* condition, the experimenter made repeated attempts to open the box for 30 seconds before locating the sliding notch and opening it.

Next, the experimenter told the child that she needed to go review some paperwork with their parents and that the child would get to play with a toy by herself. The child was also told that, because the experimenter would be on the other side of the room talking with her parents, they should ring the bell to indicate when they were done playing. The child was then given a box to play with. The box looked identical to the experimenter's box but had a different toy inside and was impossible to open. The experimenter then moved out of the child's line of sight to talk to their parents. If the child asked a question during the free play period the experimenter always responded by saying "I'm talking with your mom/dad right now. Just ring the bell when you're all done playing." The experiment was terminated when the child rang the bell or after four minutes, whichever came first. The experimenter always ended by saying, "Oops, I gave you the wrong box to open!" Children were given a different box, and working with the experimenter, always opened the box in the end.

### Results

All results were coded from videotape by two coders blind to condition (inter-rater reliability $r$=.99, $p$<.001). Because children spent almost all of the time manipulating the box before ringing the bell, we used latency to ring the bell as the dependent measure indexing children's persistence in all conditions (using an average score from both coders). To avoid the problems associated with null hypothesis significance tests, we used a bootstrap method with 10,000 samples to estimate 95% confidence intervals throughout. (See Cummings, 2008). Children in the Effort Success condition persisted significantly longer than children in the immediate success condition[1] (Mean Effortful Success: 107.23 s, 95% CI [75.8, 136.5]; Mean Immediate Success: 56.92 s, 95% CI [36.34, 73.0]; $\beta$ = 0.58 log seconds, $t$(50)= 2.87, $p$ <.01, 95% CI [0.19, 1.00]; See Figure 1).

[1] The dependent variable was transformed into log space so the distribution would adhere better a normal distribution

[2] The dependent variable was transformed into log space so the

The results from Experiment 1 show that children's persistence is affected by adult's persistence at a similar task. Thus, children seem to be making the inference that if achieving a goal is difficult for an adult, it will also be hard for them and therefore they must put in more effort to achieve that goal.

Experiment 1 raises the question, are children just imitating the adult's actions? If so, they are surely not doing so in a pure imitative fashion since children in both conditions persist on average more than the 5 or 30 seconds of persistence that the adult models. If children are not merely imitating, but instead are trying to figure out how much effort they should put into achieving a goal, then it should matter whether the adult model succeeds or fails. If the adult fails, whether immediately or after considerable effort, then children should not merely do what the adult does, but be less likely to persist across the board. In Experiment 2 we addressed this question by asking whether adult persistence modulates children's persistence when the adult fails to reach their action, both immediately and after effort.

## Experiment 2

### Methods

**Participants and Materials** Fifty-six 4-5 year-old children were recruited for the study, but only fifty-two were included in the data analysis (mean: 57.00 months; range: 48 - 71 months) due to not touching the toy box before ringing the bell (n=3), or experimental error (n = 1). Children were randomly assigned to one of two conditions: Immediate Quitting, and Quitting after Effort (n = 26/condition; ages were matched across conditions. Confidence intervals reported from bootstrap on mean with 10,000 samples. $\beta$ = 2.0, 95% CI [-0.02, 0.09]). The materials were the same as in Experiment 1.

**Procedure** The procedure was identical to that in Experiment 1, except for that instead of succeeding at opening the box, the experimenter now failed. In the *Immediate Quitting* condition, the experimenter manipulated the box for 5 seconds and then said, "I can't do it. Okay, I'm done." In the *Quitting after Effort* condition, the experimenter performed the same actions as in the *Effortful Success* condition except that at the end, instead of identifying the sliding notch and opening the box, she said, "I can't do it. Okay, I'm done".

### Results

As in Experiment 1, all results were coded from videotape by two coders blind to condition (inter-rater reliability $r$=.99, $p$<.001). As predicted, children's persistence did not differ by condition when the experimenter failed to reach their goal[2] (Mean Immediate Quitting: 34.94 sec, 95% CI [15.64, 48.29]; Mean Quitting After Effort: 30.0 sec, 95% CI [20.75, 38.12]; $\beta$ = 0.01 log seconds, $t$(50)= 0.03, $p$ =.97, 95% CI [-0.44, 0.42]; See Figure 1).

To simultaneously explore how effort and outcome affected children's performance, we performed a multiple regression where seconds playing with the toy were input as the dependent variable and effort, outcome, and their interaction as the independent variables. The regression revealed a positive effect of experimenter success, with children playing with the toy for a longer amount of time in the success conditions vs. the quitting conditions ($\beta$ = 0.66 log seconds, $t$(100)= 3.10, $p$ <.01, 95% CI [0.25, 1.07]). When the experimenter didn't try, children also tried longer, but the 95% confidence interval crosses over zero, suggesting this is not true ($\beta$ = 0.01 log seconds, $t$(100)= 0.01, $p$ =.97, 95% CI [-0.41, 0.45]). Finally, we found that when the experimenter put in effort and succeeded, there was a trend for children to play with the toy for longer than in any other condition ($\beta$ = 0.58 log seconds, $t$(100)= 1.90, $p$ =.06, 95% CI [-0.01, 1.20]).

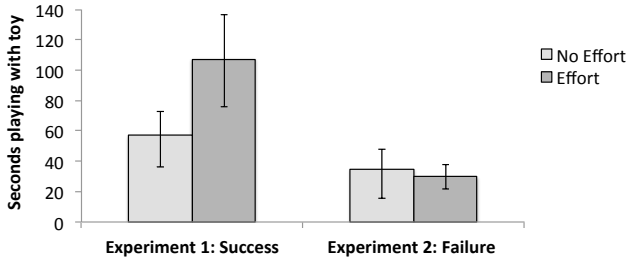


Figure 1: Time spent playing with the toy by condition with bootstrapped 95% confidence intervals

The results of Experiment 1 and 2 show that children's persistence is affected jointly by the adult's persistence at a goal and whether the adult ultimately succeeds at her goal or not. Children are most persistent when they see an adult work at a goal and succeed. They also persist (although to a lesser degree) if the goal is demonstrably achievable, even if it comes easily to the adult. However, if children have no evidence that the goal is achievable, adult persistence has no effect on children's persistence.

Note however, that in Experiment 1 and 2, the child and the experimenter played with boxes that looked identical and differed only in their contents. Thus the child and the experimenter had essentially the same task and same goal: open the box to figure out what was inside. Additionally, the child saw the experimenter persist at only a single task. In Experiment 3, we extend this investigation in two ways. First, we show children an adult modeling persistence (or succeeding readily) across two different tasks with two different goals. We then give children a third task, with yet a different goal. If adult persistence merely gives children information that "this particular task is difficult and requires persistence" then we might expect no effect of adult persistence on child persistence when the two are working on different tasks and trying to achieve different goals.

[2] The dependent variable was transformed into log space so the distribution would adhere better a normal distribution

However, if children draw the more general inference that persistence is valuable (at least in this context), then they may be more likely to persist even when the adult model has provided no information about the difficulty of the task they themselves are trying to achieve.

In Experiment 3, we also extend this investigation by asking if the effect of adult persistence on children's behavior extends into infancy. In designing the paradigm for infants, we contrasted two conditions: a success after Effort condition and a success after No Effort condition. We eliminated the Quitting conditions because pilot work suggested that when the experimenter persistently struggled in vain, infants became too fussy and inattentive to explore themselves. To ensure that the infants were equally attentive to both conditions, the experimenter manipulated the toys for the same amount of time in each condition.

## Experiment 3

### Methods

**Participants and Materials** Infants were recruited at an urban children's museum and tested individually in a quiet testing room off the museum floor. Eighty infants were recruited for the study, but only forty-four were included in the data analysis (mean: 15.43 months; range: 13-18 months) due to fussing out (n = 3), parental interference (n = 20), successfully activating the test toy (which was supposed to be impossible for the infants; n = 7), never pressing the button on the toy (n=5) or experimental error (n=1). Infants were randomly assigned to the Effort and No Effort conditions (n = 22/condition; ages were matched between conditions. Confidence intervals reported from bootstrap on mean with 10,000 samples. $\beta$ = .27, 95% CI [-0.08, 0.04]).

Two toys were used by the adult model. One toy was a tomato container with a rubber frog inside. The tomato container looked as though it could be opened by lifting off the bottom of the container, but actually opened through a sticker that peeled off at the top of the container. The other toy was a carbineer with a cow key chain attached. The key chain lit up and made cow noises when a button was pressed. An additional toy was used for the infant. The infant toy was a square box ($6.35^3$ cm) covered in felt with a button with a music symbol on the top. Although this button looked like it would activate music, a hidden button on the bottom of the toy actually activated the music. The bottom of the toy needed to be pressed firmly on a hard surface to trigger the button. The trigger was intended to be too difficult for the infants to activate. Additionally two warm-up toys (one toy that lights up and vibrates, and another toy that rattles) were used to familiarize the infant to the high chair and testing room.

**Procedure** Infants sat in a high chair or booster seat with a tray, next to their parent. The experimenter and baby played with the warm-up toys while the baby got comfortable in their high chair/ booster seat. First, the experimenter played with the tomato container for 30 seconds. In both conditions, the experimenter shook the tomato container saying, "Look, there's something inside of there! I want to get it out!" In the Effort condition, the experimenter struggled to get the toy out for 30 seconds, saying, "I wonder how I can get my toy out of here!" and making a frustrated face. She succeeded at the end. In the No Effort condition, the experimenter successfully retrieved the toy within 10 seconds and then repeated getting the toy out three times, for a total of 30 seconds, saying "Do you want to see that again?" between each attempt. Next, the experimenter played with the carabineer and key chain saying, "Look at this toy. See this!" while activating the cow keychain sound. "I want to get this off of here!" As with the tomato container in the Effort condition, the experimenter struggled to get the key chain off for 30 seconds and in the No Effort condition she took the key chain off the carabineer three times within 30 seconds.

The experimenter next introduced the infant to her toy saying, "Now it's your turn to play with a toy. See this toy! This toy makes music!" The experimenter showed the infant her toy and then placed it out of the infant's view and made the toy play music. The experimenter then handed the toy to the infant and left the room. The parent was instructed to return the toy to the infant if she passed it to them and to smile and nod but otherwise not interact with the baby. The experiment was terminated 1) if the infant fussed out 2) after the baby passed the toy to her parent and/or threw the toy off the highchair a total of three times or 2) two minutes went by, whichever came first. At the end of the experiment, the experimenter made sure the infant was successful in making the toy play music.

### Results

All results were blind coded from videotape. Because infants did not uniformly attend to the toy until they met the criteria for ending the experiment, we used a more fine-grained measure than time until the experiment was terminated. In Experiment 3, we coded both how often the infant pressed the button between the moment they were handed the toy and the moment the experiment was ended and how often infants pressed the button between the moment they were handed the toy and the first time they discarded the toy (by passing it to a parent or throwing it off the highchair). Children in the Effort condition pressed the button more times in total (Mean Effort: 25.09, 95% CI [17.28, 32.36], Mean No Effort: 14.72, 95% CI [8.87, 20.18]) and before first handoff (Mean Effort: 18.60, 95% CI [11.78. 24.59], Mean No Effort: 11.05, 95% CI [6.09, 15.22]; See Figure 2) than children in the No Effort condition. In a linear regression[3], we found a positive effect of experimenter effort, with children pressing the button more times in total, and before handoff, in the Effort vs. the

[3] The dependent variable was transformed to the 0.5 power so that the distribution would adhere better to a normal distribution.

No Effort condition (total number press: $\beta$ = 1.30, $t(42)$= 2.43, $p$ =.02, 95% CI [1.55, 3.71], number press pre-handoff, $\beta$ = 1.16, $t(42)$= 2.28, $p$ =.03, 95% CI [1.25, 3.37]).

This effect was not driven by children in the No Effort group handing off the toy more than children in the Effort group (Mean Effort: 2.45, 95% CI [2.04, 3.00], Mean No Effort: 1.95, 95%CI [1.46, 2.55]; Bootstrap mean difference: 0.5, 95% CI [-0.17, 1.18]). Thus, not only did children in the Effort condition try harder to make the toy work by pressing the button more overall, they also tried harder to make it work before asking an adult for help or throwing the toy in frustration.

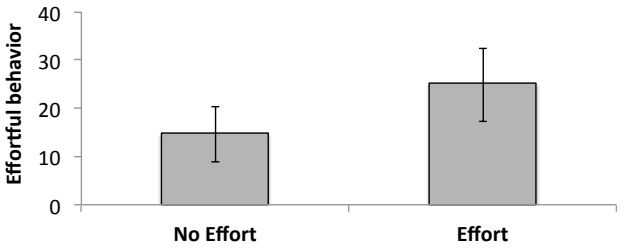


Figure 2: Total number of button presses by condition with bootstrapped 95% confidence intervals

## Discussion

This study looked at whether preschool age children and infants learn when to deploy effort by observing adult behavior. The findings from Experiment 1 and 2 suggest that adult models convey at least two kinds of information that affect children's persistence: whether the goal requires effort to achieve and whether the goal is achievable. Preschoolers' persistence was modulated by both these factors. Preschoolers persisted most when an adult persisted successfully, significantly less when an adult succeeded effortlessly, and less still when the adult failed to achieve the goal. Indeed, when the adult failed to achieve the goal, the adult's persistence (or lack thereof) had no impact on children's persistence. Experiment 3 extended these findings to suggest that 13- to 18-month-old infants also use adult models to modulate their persistence, and they do so in relatively far-reaching ways. Infants were more likely to persist in their attempts to activate a toy when an adult had persisted, even though the adult had entirely different goals (opening a container and removing a keychain) than the infant (activating music). This suggests that, infants, like older children, are sensitive to adult persistence and use it to calibrate their own tenacity; moreover, infants do not merely learn that a particular task may be difficult. They draw a broader generalization that at least extends to the inference that all the toys they are playing with in the experiment require a high level of persistence to succeed.

However, these findings also raise a number of questions. First, although this study points to adult persistence and the achievability of a goal as factors that affect infants and preschoolers' persistence, many more factors may affect persistence in the real world. These include the perceived complexity of the task, the perceived competence of the adult model, the child's past experience succeeding or failing at comparable tasks, the child's motivation to achieve the outcome, the availability (or unavailability) of graded evidence suggesting progress towards a goal, and the child's temperament. How these factors interact to affect children's perseverance remains a rich area for future research.

Second, we have alluded to the difficulty in establishing how far children generalize the inference that they should (or should not) persist at a task. The results of Experiment 3 suggest that children learn something more than merely "this particular task requires perseverance." However, to what degree children learn something about the value of persistence in the face of frustration across contexts remains unknown. Indeed, although perseverance is a culturally valued trait, not every task is worth persisting on. An optimal learner should be sensitive both to the conditions under which they should persist and when they should not. Recent research suggests that even toddlers can assess the costs and rewards of agent actions (Jara-Ettinger, Tenenbaum, & Schulz, 2015); this sensitivity to the utility of actions could also support children's decisions about how hard to try.

Finally, as noted, the majority of research on children's attitudes towards efforts and its relationship with achievement has been conducted in school-age children (see Yeager & Dweck, 2013). The findings from the current study provide initial evidence that as early as infancy, children calibrate their own effortful behavior based on adult's effortful behavior. However, in the current study, we measured only children's persistence on a task; in future work it would be interesting to know how adult models affect children's more explicit theories of their own abilities (e.g., judgments of self-efficacy; Zimmerman & Ringle, 1981). Considering that perseverance, and beliefs about the value of perseverance, have a very real-world impact on school achievement (Duckworth & Seligman, 2005; Eskreis-Winkler, Shulman, Beale, & Duckworth, 2014), future research might look at how evidence for the value of persistence within and across contexts affects children's long term theories about themselves and their real world outcomes.

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## References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review, 84,* 191-215.

Bekkering, H., Wohlschla, A., & Gattis, M. (2000). Imitation of gestures in children is goal-directed. *The Quarterly Journal of Experimental Psychology, 53a*, 153–164. doi:10.1080/713755872

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: a longitudinal study and an intervention. *Child Development*, *78*, 246–63. doi:10.1111/j.1467-8624.2007.00995.x

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N. D., Spelke, S., & Schulz, L. E. (2011).The double-edge sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition, 120*, 322-330. doi: 10.1016/j.cognition.2010.10.001

Burhans, K. K., & Dweck, C. S. (1995). Helplessness in early childhood : The role of contingent worth. *Child Development, 66,* 1719–1738. doi: 10.1111/j.1467-8624.1995.tb00961.x

Cimpian, A. (2010). The impact of generic language about ability on children's achievement motivation. *Developmental Psychology*, *46*, 1333–40. doi:10.1037/a0019665

Cook, C., Goodman, N. D., & Schulz, L. E. (2011). Where science starts: spontaneous experiments in preschoolers' exploratory play. *Cognition*, *120*, 341–9. doi:10.1016/j.cognition.2011.03.003

Cummings, G. (2008). Replication and p intervals: P values predict the future only vaguely, but confidence intervals do much better. *Psychological Science, 3*, 286-300. doi: 10.1111/j.1745-6924.2008.00079.x

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents, *Psychological Science, 16*, 939–944. doi: 10.1111/j.1467-9280.2005.01641.x

Eskreis-Winkler, L., Shulman, E. P., Beal, S. a, & Duckworth, A. L. (2014). The grit effect: Predicting retention in the military, the workplace, school and marriage. *Frontiers in Psychology*, *5,* doi:10.3389/fpsyg.2014.00036

Gergely, G., Bekkering, H., & Kiraly, I. (2002). Rational imitation in preverbal infants. *Nature, 4115,* 755. doi:10.1038/415755a

Gunderson, E. A., Gripshover, S. J., Romero, C., Dweck, C. S., & Levine, S. C. (2014). Parent praise to 1-3 year-olds predicts children's motivational frameworks 5 years later. *Child Development*, *84*, 1526–1541. doi:10.1111/cdev.12064.

Gweon, H., Pelton, H., Konopka, J. A., & Schulz, L. E. (2014). Sins of omission: Children selectively explore when teachers are under-informative. *Cognition*, *132*, 335–41. doi:10.1016/j.cognition.2014.04.013

Harris, P. (2012). *Trusting what you're told: How children learn from others*. Cambridge, MA: Belknap Press.

Jara-Ettinger, J. Tenenbaum, J. & Schulz, L. E. (2015). Not so innocent: Toddlers' inferences about costs and culpability. *Psychological Science,* doi:10.1177/0956797615572806

Kenward, B., Karlsson, M., & Persson, J. (2011). Over-imitation is better explained by norm learning than by distorted causal learning. *Proceedings. Biological Sciences / The Royal Society*, *278*, 1239–46. doi:10.1098/rspb.2010.1399

Legare, G. H. (2012). Exploring explanation: Explaining inconsistent evidence informs exploratory, hypothesis-testing behavior in young children. *Child Development, 83*, 173-185. doi: 10.1111/j.1467-8624.2011.01691.x

Lutz, D. J., & Keil, F. C. (2002). Early Understanding of the Division of Cognitive Labor. *Child Development, 73*, 1073–1084. doi: 10.1111/1467-8624.00458

Lyons, D. E., Young, A. G., & Keil, F. C. (2007). The hidden structure of overimitation. *Proceedings of the National Academy of Science, 104*, 19751–19756. doi: 10.1073/pnas.0704452104

McGuigan, N., Whiten, A., Flynn, E., & Horner, V. (2007). Imitation of causally opaque versus causally transparent tool use by 3- and 5-year-old children. *Cognitive Development*, *22*, 353–364. doi:10.1016/j.cogdev.2007.01.001

Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment by 18-month-old children. *Developmental Psychology, 24*, 838-850.

Schneider, S. L. (1998). Performance prediction in young children: effects of skill, metacognition and wishful thinking. *Developmental Science, 1*, 291-297. doi: 10.1111/1467-7687.00044

Schulz, L. E., & Bonawitz, E. B. (2007). Serious fun: Preschoolers engage in more exploratory play when evidence is confounded. *Developmental Psychology*, *43*, 1045–50. doi:10.1037/0012-1649.43.4.1045

Schulz, L. E., Hooppell, C., & Jenkins, A. C. (2008). Judicious imitation: Children differentially imitate deterministically and probabilistically effective actions. *Child Development, 79*, 395-410. doi: 10.1111/j.1467-8624.2007.01132.x

Smiley, P. A., & Dweck, C. S. (1994). Individual differences in achievement goals among young children. *Child Development, 65,* 1723–1743.

Williamson, R. A., Meltzoff, A. N., & Markman, E. M. (2008). Prior experiences and perceived efficacy influence 3-year-olds' imitation. *Developmental Psychology, 44*, 275-285. doi: 10.1037/0012-1649.44.1.275

Wimmer, H., Hogrefe, G. J., & Perner, J. (1988). Children's understanding of informational access as source of knowledge. *Child Development, 59*, 386-396.

Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist*, *47*, 302–314. doi:10.1080/00461520.2012.722805

Zimmerman, B. J., & Blotner, R. (1979). Effects of model persistence and success on children's problem solving. *Journal of Educational Psychology, 71,* 508-513.

Zimmerman, B. J., & Ringle, J. (1981). Effects of model persistence and statements of confidence on children's self-efficacy and problem solving. *Journal of Educational Psychology, 73,* 485-493.